

APPENDIX 1

/ DEFINITIONS RELATING TO METALS AND METALWORKING

These definitions apply to the scrap industry and to mill products in any form as supplied by the mills. Materials in process in the mills are sometimes referred to by terms other than those applied to the materials as supplies.

AGE HARDENING—A process of increasing the hardness and strength by the precipitation of particles of a phase from a supersaturated solid-solution alloy. The hardening cycle usually consists of heating or annealing at a temperature sufficiently high to maintain solid solution, rapid cooling or quenching to retain the supersaturated solid solution, and subsequent heating at a temperature lower than the solution anneal to effect the precipitation.

ALLOY—A substance having metallic properties and composed of two or more elements, at least one of which is a metal.

ANGLE—A shape consisting of two straight legs meeting in a right angle, usually (but not necessarily) of equal length and with a sharp or slightly rounded corner and with or without fillets.

ANNEALING—A process involving heating and cooling designed to effect: (1) softening of a cold-worked structure by recrystallization or grain growth or both; (2) softening of an age-hardened alloy by causing a nearly complete precipitation of the second phase in relatively coarse form; (3) softening of certain age-hardenable alloys by dissolving the second phase and cooling rapidly enough to obtain a supersaturated solution; and (4) relief of residual stress.

ANODE—(1) In corrosion processes, usually the metal that has the greater tendency to dissolve. (2) In electroplating, the positive electrode used in a plating bath.

AS-HOT-ROLLED—A condition of a metal mill product resulting from hot rolling, soft, not cleaned nor drawn or rolled to size.

AS-IS-STATE—Represents that the quality of the lot is based on the analysis findings in the "As is" state without predetermination or accountability for the burning loss (B/L).

BILLET—A solid cylindrical casting used for hot extrusion into rod, bar, tube, or shape or for hot piercing into tube.

BLADES—Refer to the turbine rotor blades or bucket blades associated with the jet engine or the steam engine, and which is the motive part on

which the gas or pressure steam impinges and transmits the power to create motion.

BLANKING—The process of cutting metal blanks by a die and punch set in a press, or by sawing or shearing.

BLISTER—A void in, or raised spot on the surface of a metal, caused by expansion of entrapped gas in the metal.

BRASS—Any copper-base alloy with zinc as the principal alloying element, with or without small quantities of some other elements.

BRASSES (copper alloys):

Admiralty—A tin brass containing nominally 70 percent copper; 1 percent tin and 29 percent zinc, originally developed by the British Admiralty and generally available in tube, flat products and wire. Its principal use is in heat exchanger and condenser tubes. An inhibitor may be added to increase the resistance to dezincification.

Admiralty, Inhibited (antimonial, arsenical or phosphorized)—Admiralty modified by the addition of .02-10 percent of antimony, arsenic or phosphorus to inhibit dezincification.

Aluminum Brass—A brass containing nominally 76 percent copper, 2 percent aluminum and 22 percent zinc with an inhibitor, available in tube form. Its principal use is in heat exchanger and condenser tubes.

Architectural Bronze—A brass containing nominally 57 percent copper, 3 percent lead, and 40 percent zinc, generally available in extruded or drawn shapes and rod; used for architectural trim and for some mechanical applications. The alloy is not technically a bronze but because of long usage the term "Architectural Bronze" has gained widespread acceptance.

Cartridge Brass, 70 Percent—A brass containing nominally 70 percent copper and 30 percent zinc and generally available in pin products, rod, wire and tube.

Clock Brass—A term sometimes used to designate high-leaded brass suitable for specific uses. It is recommended that this alloy be identified by the term "high-leaded brass" properly qualified for the specific use.

Collet Brass—A term sometimes used, but not recommended. See High-Leaded Brass and Free-Cutting Brass.

Commercial Bronze, 90 Percent—A brass containing nominally 90 percent copper and 10 percent zinc, generally available in flat products, wire, rod and tube. The alloy is not technically a bronze, but because of long usage the term “commercial bronze” has gained widespread acceptance.

Core Brass—See Radiator Core Brass.

Deep Drawing Brass—A term sometimes used, but not recommended, to denote nonlead brasses of nominal copper content ranging from 65 to 70 percent. See Yellow Brass, or Cartridge Brass, 70 percent.

Engraver's Brass—A term sometimes used, but not recommended. See High-Leaded Brass.

Etching Brass—A term used to indicate quality of material rather than chemical composition. The term signifies a flat product having unusual freedom from surface defects; very flat and usually of quarter-hard or half-hard temper.

Extra-high-leaded Brass—A brass containing nominally 63 percent copper, 2.5 percent lead, and 34.5 percent zinc, generally available in flat rolled products, and used for engraving and other operations requiring considerable cutting.

Eyelet Brass—A term sometimes used, but not recommended. See Cartridge Brass, 70 percent.

Forging Brass—A brass containing nominally 59 percent copper, 2 percent lead, and 39 percent zinc, generally available in rod, bar, tube and shapes and recommended for fabrication by hot-forging and hot-pressing. It has excellent machinability, approaching that of free-cutting brass.

Free-Cutting Brass—A brass containing nominally 61.5 percent copper, 3 percent lead and 35.5 percent zinc, generally available in rod and drawn bar and in extruded shapes. It is the most commonly used alloy for automatic screw machine work, or for other applications where material of maximum machinability is desired.

Free-Cutting Muntz Metal—A brass containing nominally 60 percent copper, 1 percent lead and 39 percent zinc. Generally available as tube. It is used for automatic-screw machine products where maximum machinability is not necessary.

Gilding, 95 percent—A brass containing nominally 95 percent copper and 5 percent zinc. This alloy is generally available in flat products, rod and wire.

High-Leaded Brass—A brass containing nominally 65 percent copper, 2 percent lead, and 33 percent zinc, generally available in flat products and rod. It is used where easy stamping and machining are desired, as for instance, in clock and watch backs and gears and for engraving.

High-Leaded Brass (tube)—A brass containing nominally 66 percent copper, 1.6 percent lead, and

32.4 percent zinc. It is recommended for automatic screw machine operations.

Jewelry Bronze—87.5 percent—A brass containing nominally 87.5 percent copper and 12.5 percent zinc having a rich golden color. It is used for costume jewelry, slide fasteners and as a base for gold-filled articles. Variations may contain small amounts of tin.

Leaded Commercial Bronze—A brass containing nominally 89 percent copper, 1.75 percent lead and 9.25 percent zinc generally available in rod, shapes and bar, and used extensively for hardware. The alloy is not technically a bronze, but because of long usage the term “leaded commercial bronze” has gained widespread acceptance. Hardware bronze is a term formerly used to designate any one of a broad range of similar alloys; this term is not recommended.

Leaded Muntz Metal—A brass containing nominally 60 percent copper, 0.6 percent lead, and 39.4 percent zinc generally used for condenser tube plates.

Leaded Naval Brass—A brass containing nominally 60 percent copper, 0.75 percent tin, 1.75 percent lead and 37.5 percent zinc, generally available in rod, shapes and bar. This alloy has the equivalent strength and corrosion resistance of naval brass plus considerably improved machinability.

Leaded Red Brass—A brass containing nominally 85 percent copper, 2 percent lead and 13 percent zinc, generally available in rod and drawn bar. Hardware bronze is a term formerly used to designate any one of a broad range of similar alloys; this term is not recommended.

Low Brass, 80 percent—A brass containing nominally 80 percent copper and 20 percent zinc and generally available in flat products, rod and wire.

Low-Leaded Brass—A brass containing nominally 65 percent copper, 0.5 percent lead, and 34.5 percent zinc, and generally available in flat products. It is widely used for stamping and light drawing operations.

Manganese Bronze—A brass containing nominally 58.5 percent copper, 1 percent tin, 1.4 percent iron, 0.1 percent manganese and 39 percent zinc, generally available in rod, flat products shapes and wire. This alloy is appreciably harder and stronger than naval brass and is, therefore, preferred to the latter for many structural uses. It is also an excellent brazing alloy.

Muntz Metal—A brass containing nominally 60 percent copper and 40 percent zinc and generally available in flat products, rod, wire, and tube.

Naval Brass—A brass containing nominally 60 percent copper, 0.75 percent tin and 39.25 percent zinc, generally available in rod, bar, wire, shapes,

tube and to some extent in flat products. It is used in marine construction where a strong, hard material is required.

Plater's Brass—A term sometimes used, but not recommended, to indicate specific alloys used as anodes for brass plating. These vary in composition from 30 to 90 percent copper, 10 to 20 percent zinc, and sometimes 1 to 2 percent tin.

Primer Brass—A term sometimes used, but not recommended, to denote a specific alloy used for making primer caps and tubes. Primer caps are made from cartridge brass, 70 percent; commercial bronze, 90 percent; or gilding, 90 percent. Primer tubes are made from low-leaded or high-leaded brass.

Radiator Core Brass—A term used to indicate strip brass of suitable characteristics for forming radiator cores. It is sometimes used, but not recommended, to designate a specific alloy.

Red Brass, 85 percent—A brass containing nominally 85 percent copper, 5 percent tin, 5 percent lead, and 5 percent zinc.

Reflector Brass—A term used to indicate strip brass with suitable characteristics for forming into reflectors. It is sometimes used, but not recommended, to designate a specific alloy, usually yellow brass or cartridge brass, 70 percent, having a small grain size which will take a moderately deep draw and a very high polish.

Yellow Brass—A brass containing nominally 65 percent copper and 35 percent zinc and generally available in flat products, wire and rod.

70-30 Brass—A term sometimes used, but not recommended, for cartridge brass, 70 percent copper, and 30 percent zinc.

BRAZE WELDING—A method of welding whereby a groove, fillet, plug or slot weld is made using a nonferrous metal having a melting point below that of the base metals but above 800°F. The filler metal is not distributed in the joint by capillary attraction. (The term "bronze welding," formerly used, is a misnomer for this process.)

BRAZING—A joining process wherein coalescence is produced by heating to suitable temperatures above 800°F, and by using a nonferrous filler metal having a melting point below that of the base metals. The filler metal is distributed between the closely fitted surfaces of the joint by capillary attraction. See also Soldering.

BRONZE—Originally a term for copper-base alloys having tin as the only or principal alloying elements. In modern usage the term "bronze" is seldom used alone, and the terms "phosphor bronze" or "tin bronze" are considered preferable for indicating copper-tin alloys. In fact, the term "bronze" together with a suitable modifying adjective has in recent years been extended to apply to

any of a great variety of copper-base alloy systems, and such usage has gained widespread acceptance. The more important alloys designated as bronzes are as follows:

Aluminum Bronzes—Copper-base alloys with aluminum as the principal alloying element, normally in the range of 3 to 11 percent with or without the additions of other elements.

Architectural Bronze—See Brasses.

Commercial Bronze, 90 percent—See Brasses.

Leaded Commercial Bronze—See Brasses.

Manganese Bronze—See Brasses.

Phosphor Bronzes—Copper-base alloys with tin as the principal alloying element deoxidized with phosphorus. Various types are available in flat products, rod, tube, wire and shapes, the most common ones containing nominally 1.25 percent to 10 percent tin.

Silicon Bronzes—Any copper-base alloy with silicon as the main alloying element, with or without additions of such elements as zinc, manganese, aluminum, iron or nickel. The more commonly used silicon bronzes are: (1) high-silicon bronze, nominally containing 96 percent copper and 3 percent silicon; and (2) low-silicon bronze, nominally containing 97.7 percent copper and 1.5 percent silicon.

Tin Bronze—See Phosphor Bronzes.

BURNING LOSS (B/L)—Refers to the percentage of water, oil, other extraneous moisture and combustible matter which by ignition or evaporation method is determined as a separate part of the analysis procedure.

BUS BAR AND BUS CONDUCTOR—Rigid, high-conductivity copper electrical conductor of tubular or solid section.

BUTTON ANALYSIS—The meltdown of a sample, usually in the "as is" state, and the casting of the molten metal into a button or bar-shape mold, whereby the metallic content is determined by the difference between the input and output weight. The button is then assayed for the required elements and, by calculation, the analysis may be deduced and reported either for the "as is" state or on the metallic yield basis.

CASTINGS—By trade history, "castings" are considered a distinct physical form of solids. It is accordingly described here to convey the understanding that this form of scrap does not originate from rolled, forged or extruded source.

CHANNEL—A shape having two straight flanges or legs of equal length, extended at right angles from same side of the edges of a web or base, the legs and base having sharp or slightly rounded corners and with or without fillets.

CIRCLE—A completely round, commercially flat, solid blank made from a flat rolled product.

CLEAN—Meaning a state or condition of cleanliness; namely, free of paint, insignificant in moisture content, or deleterious external matter.

CLIPPING—The operation of trimming or cutting off uneven edges of forgings or articles drawn or formed from sheet or strip.

COLD WORKING—The process of changing the form or cross section of a piece of metal at a temperature below the softening or recrystallization point, but commonly at or about room temperature. It includes rolling, drawing, pressing and stretching.

CONDENSER TUBE—See Tube, Heat Exchanger Tube.

CONDENSER TUBE PLATE—Plate manufactured to special thickness tolerances and furnished in various contours as tube sheets or head plates in condensers and heat exchangers.

COPPER—Commercially pure copper-metal for which the specified minimum copper content is not less than 99.88 percent, silver being counted as copper. Modified copper—metal for which the specified minimum copper content is less than 99.88 percent and more than 99.3 percent, silver being counted as copper.

COPPER TYPES:

Arsenical, tough-pitch copper (A TP)—A modified tough-pitch copper containing substantial amounts of arsenic regardless of origin or treatment.

Cathode Copper—A commercially pure copper electrolytically refined in cathode form.

Coalesced Copper—A commercially pure oxygen-free copper formed in a protective atmosphere at elevated temperature but below its melting point by application of mechanical pressure to particles of electrolytic cathode copper.

Deoxidized Arsenical Copper (DPA)—A modified deoxidized copper containing the designated element (arsenic) in amounts as agreed upon between the supplier and the consumer mainly for the purpose of increasing corrosion resistance.

Deoxidized Copper Low Residual Phosphorus (DLP) (High Conductivity)—A commercially pure copper which has been deoxidized with phosphorus in such a manner as to leave a very low residual phosphorus content. It is not readily susceptible to hydrogen embrittlement, and has a conductivity approximately equivalent to that of tough-pitch copper.

Deoxidized Copper, Silver Bearing (DPS)—A commercially pure deoxidized copper containing the designated element (silver) in amounts as agreed upon between the supplier and the consumer.

Deoxidized Copper, Tellurium Bearing (DPTE)—A modified deoxidized copper containing the designated element (tellurium) in amounts as agreed upon between the supplier and the consumer to improve machinability. The conductivity is somewhat lower than that of electrolytic tough-pitch copper.

Electrolytic Tough-Pitch Copper (ETP)—A commercially pure copper of any origin which has been refined by electrolytic disposition, then melted, oxidized and brought to tough-pitch or controlled low-oxygen content, and finally cast into cakes, billets, wire bars, etc., suitable for hot or cold working, or both.

Fire-Refined Copper (FRHC and FRTP)—A commercially pure copper of any origin or type which is finished by furnace refining without, at any stage, having been electrolytically refined.

Lake Copper—A commercially pure copper from the Lake Superior district, generally fire refined and containing variable, but controlled, amounts of silver and arsenic. Such copper of low-arsenic content is called Prime Lake Copper, while that of higher arsenic content is called Arsenical Lake Copper—also low, medium and high Arsenical Lake Copper. Also see Arsenical Copper and Silver-Bearing Copper.

Oxygen-Free Copper (OF)—A commercially pure copper which has been produced in such a manner as to contain no oxide or residual deoxidants. It has very high resistance to hydrogen embrittlement and has equal or better conductivity than tough-pitch copper.

Oxygen-Free Silver-Bearing Copper (OFS)—A commercially pure high-conductivity copper containing the designated element (silver) in amounts as agreed upon between the supplier and the consumer for the purpose of raising the softening temperature.

Phosphorus Deoxidized Copper, High-Residual Phosphorus (DHP) (Low Conductivity)—A commercially pure copper which has been deoxidized with phosphorus, leaving a relatively high-residual phosphorus content. It is not susceptible to hydrogen embrittlement but is of relatively low conductivity due to the amount of phosphorus present.

Silver-Bearing (Argentiferous) Copper—Any copper containing substantial amounts of silver, regardless of origin or treatment.

Silver-Bearing Arsenical, Tough-Pitch Copper (SATP)—A modified tough-pitch copper containing the designated elements (silver and arsenic) in amounts as agreed upon between the supplier and consumer mainly for the purpose of increasing corrosion resistance and raising the softening temperature.

Silver-Bearing Tough-Pitch Copper (STP)—A commercially pure high-conductivity tough-pitch copper containing the designated element (silver) in amounts agreed upon between the supplier and the consumer for the purpose of raising the softening temperature.

Tough-Pitch Copper—Commercially pure or modified copper, either electrolytically or fire refined, containing a controlled amount of oxygen for the purpose of obtaining a level set in the casting.

COPPER ANODE—See Anode.

COPPER-BASE ALLOY—Metal for which the specified minimum copper content is less than 99.3 percent and not less than 40 percent and having no other element specified in excess of the copper content.

COPPER-BERYLLIUM ALLOY—A heat-treatable copper alloy containing 1.50-2.25 percent beryllium and sometimes small amounts of cobalt, nickel and chromium. It is capable of being formed readily when in the soft condition and heat treated to hardnesses approaching those of steel.

CORROSION—The deterioration or failure of metals and alloys by chemical or electrochemical processes.

Cavitation—The damage caused to a material by moving liquid and associated with the formation and collapse of cavities in the liquid at the solid-liquid interface.

Dealuminification—A phenomenon somewhat similar to dezincification involving loss of aluminum.

Denickelification—A common phenomenon somewhat similar to dezincification involving loss of nickel.

Dezincification—Corrosion of an alloy containing zinc (usually brass) involving loss of zinc.

Erosion—The abrasion of metal or other material by liquid or gas, usually accelerated by presence of solid particles of matter in suspension, and sometimes by corrosion.

Impingement Attack—A type of localized corrosion caused by the striking of a liquid containing entrained gasses on a metal surface.

Stress Corrosion—Spontaneous failure of metals by cracking under combined action of corrosion and stress, residual or applied.

CORROSION FATIGUE—The deterioration of properties resulting from repeated stressing of a metal in a corrosive medium. The rate of deterioration is greater than that resulting from either repeated stressing or corrosion alone.

CUPRO-NICKEL (COPPER NICKEL)—A copper-base alloy composed of copper and nickel with nickel content usually being 10, 20, or 30

percent and with small additions of elements such as iron and manganese.

DEOXIDIZED—A term applied to any metal or alloy to indicate that it has been treated to remove oxygen. It is specifically applied to copper and refers to removal of oxygen by means of phosphorus or other strong deoxidizing agents.

DICED TURNING—Synonymous to “short shoveling,” describes the treatment of machine shop turnings reduced *through the attrition of a hammer or cog mill* to a state of under 2 inches in length.

DRAWING—(1) The process of pulling flat products, rod, wire, tube, shapes, etc., through a die. This effects a reduction in size or change in shape of the cross section and hardens the metal. (2) The process of making articles in a press from blanks cut from flat products in which the gage is reduced by pushing the metal between a punch and die to develop the sidewalls of the part.

DRYWEIGHT—Represents the payable weight of the material content as determined by analysis and after allowance or deduction of the B/L.

DUCTILITY—The property of a metal that permits permanent deformation before fracture by stress in tension.

EXTRUDED BAR, EXTRUDED ROD, EXTRUDED SHAPE, EXTRUDED TUBE, EXTRUDED WIRE—Stock brought to final dimensions by extrusion.

EXTRUSION, HOT—The process of shaping metal into a chosen continuous form by forcing it from a closed container through a die of appropriate shape.

EXTRUSION PIPE—A defect that occurs during extrusion and is located internally at the back end of the extruded piece. This defect is removed by cropping off the back end.

EYELET BRASS—See Brasses.

FATIGUE—The tendency for a metal to break under conditions of repeated cyclic stressing considerably below the ultimate tensile strength.

FERRULE—Metal ring or collar used in installation of boiler flues, condenser tubes and similar applications.

FILLER METAL—A metal or alloy which is melted down in a welding or brazing operation to supply metal for the joint.

FINISH—The condition of the surfaces of the products, produced by normal or special mill procedures. Several types of finishes can be produced as follows:

Acid Dipped Dry Rolled Finish—The finish obtained by cold dry rolling on polished rolls of material, previously bichromate dipped or bright

dipped, giving a burnished appearance and retaining the color obtained by dipping.

Bright Annealed Finish—The finish obtained by annealing under conditions of controlled atmosphere to prevent oxidation and to retain the original luster of the product. See also Annealing.

Bright-Dipped Finish—A bright finish having the true color of the metal obtained by immersion in an aqueous solution of sulfuric acid and nitric acid, using the following formula: Sulfuric acid, 2 gallons; nitric acid, 1 gallon; water, 1 to 2 quarts; hydrochloric acid, % fluid ounce.

Bright Rolled Finish—See Dry Rolled Finish.

Brush Brass Finish—A frosted finish obtained on brass by brushing with a Tampico (Bristol brush) wheel treated with brush rouge and rotating at high speed.

Buffed Surface Finish—The finish obtained by buffing with rouge or similar abrasive, resulting in a high gloss or polish. This may be applied in one operation or two, commonly known as cutting and coloring operations.

Clean Annealed Finish—A finish characterized by a light iridescent film generally obtained on copper-base alloys which have been annealed in a controlled atmosphere.

Cold Rolled Finish—The finish obtained by cold rolling of plain pickled strip with a lubricant; giving a relatively smooth appearance. In the case of sheet or strip, cold rolling may be done without any lubricant, the finish then being similar to that described under Dry Rolled Finish.

Drawn Finish—The finish obtained on tube, wire, and drawn rod, bar and strip by drawing through a die resulting in a relatively smooth and bright appearance.

Dry Rolled Finish (Bright Rolled Finish)—(1) The finish obtained by cold rolling on polished rolls without the use of any coolant or metal lubricant on material previously plain pickled, bichromate or bright dipped; (2) The finish obtained by the rolling or tumbling of brass articles in a barrel with either dry sawdust, leather or scrap. cork.

Extruded Finish—The finish obtained on tube, wire, and rod, bar and strip by hot extrusion through a die, resulting in a slightly oxidized and dull appearance. . . .

Hot Rolled Finish—The finish obtained by rolling metal while hot resulting in a dark oxidized and relatively rough surface.

FLAT PRODUCT—A product with rectangular or square solid section and relatively great length in proportion to thickness.

Drawn Flat Product—Flat product brought to final dimensions by drawing through a die, and furnished in flat straight lengths, on spools, or in

rolls. The corners or edges may be square or of other contours.

Rolled Flat Product. —Flat product brought to final thickness by rolling, and furnished in flat straight lengths, on spools, or in rolls. Longitudinal edges may be those resulting from final rolling to thickness or the product may be brought to final width by shearing, slitting, sawing, machining or rolling. The corners or edges may be square or of other contours.

FLATTENING.—The mill operation performed on rolled flat products to reduce departure from flatness, such as curl and dish.

FLUX—(1) In melting, a substance added to the melt to promote removal of foreign materials, and protect the surface. (2) In brazing or welding, a substance introduced to remove oxide and impurities.

FOIL—A term often applied to a thin flat rolled section usually .005 inch or less in thickness.

FOUNDRY SPILLS, SPATTERS AND SKULLS—Refers to the characteristic foundry salvage resulting from the surface oxidation of the melting operation which is skimmed off. It may result from the spilling of metal in the casting operation, the metal skullings that cling to the walls of the pouring ladle or furnace walls, the runoff of the accumulated furnace bottoms, or it may consist of such metal of porous oxidized condition unsuited for further foundry reuse. Usually foundry skulls, spills, and spatters may range from a high of 95 percent metallic content and dependent on the cleanliness or freedom of adhesive scale, oxide, dirt, and brick matter termed “silicious matter”, may dip to a low of 50 percent of metallic content. Accordingly, it is vital that the metallic yield should be noted for any parcel of this nature.

FOURDRINIER WIRE—Wire used in making the Fourdrinier screens used in the manufacture of paper.

FREE MACHINING—The quality of an alloy which enables it to be cut in automatic machines at relatively high speeds, yielding a short brittle chip.

GAGE—(1) Term sometimes used to designate thickness of flat products, wall thickness of tube or diameter of wire. (2) The instrument used to measure thickness or diameter.

GAGE NUMBER—A number in a specific series used to designate a dimension. There are several series of such gage numbers, of which the most familiar are the American Wire Gage or Brown & Sharpe and Birmingham or Stubs.

GASSING—(1) A phenomenon in metal caused by absorption of gas while molten and partial evo-

lution as the metal cools, resulting in voids. (2) A condition in oxygen-bearing copper which has been heated to elevated temperatures in a highly reducing atmosphere.

GRAIN—A solid polyhedral (or many-sided) crystal consisting of groups of atoms bound together in a regular geometric pattern. In mill practice, grains are usually studied only as they appear in one plane.

GRINDINGS—The occurrence of *grindings* derived from the processing termed “metal dressing.” The friction of a high-speed grinding wheel results in a conglomerate *Byproduct* consisting of somewhat oxidized metal particles and grinding wheel matter. The particles usually are under $\frac{1}{4}$ inch in screen size and tend to curl and intertwine to form a condition termed “clumsiness.” The term “free flowing condition” merely signifies that the grindings can be worked by hand shoveling or pitchfork. The term “frozen condition” implies that the grindings have been exposed to water inclusion and have become congealed or surface crusted. Such condition does not bear on the quality of the material and, in effect, indicates that the grindings may require hammer mill treatment to reduce to free shoveling state.

HALF HARD TEMPER—See Temper.

HAMMER FORGING—A forging process in which the piece is deformed by repeated blows.

HAND STRAIGHTENING—See Straightening.

HARD TEMPER—See Temper.

HARDNESS—The resistance of metal to plastic deformation by indentation. The most common method of measurement is Rockwell. Other methods are Brinell, Scleroscope, Tukon and Vickers.

HARDNESS NUMBER—The number used to designate the hardness of metal. The number is related to the scale of values of a particular hardness test, as Rockwell B 80 or Brinell 150.

HEAT TREATMENT—A combination of heating and cooling operations applied to a metal or alloy in the solid state to produce changes in physical and mechanical properties. See also Age Hardening and Annealing.

INGOT MAKER—A nonferrous manufacturer who heats secondary material (scrap) in a furnace, melting into ingots of a prescribed specification.

INHIBITORS—Elements added in small amounts to alloys to increase the resistance of the alloys to corrosion.

LAKE COPPER—See Copper Types.

LAP—A surface defect appearing as a seam, caused by folding over hot metal, tins, or sharp corners and then rolling or forging, but not welding, them into the surface.

LEADED BRASSES—Copper-base alloys, generally of copper and zinc to which lead has been added to improve machinability. See Brasses.

LENGTHS—The terms employed to designate lengths are as follows:

Mill Lengths—Certain uniform lengths subject to established tolerances with short lengths included according to established schedule.

Multiple Lengths—Lengths of integral multiples of a base length, with suitable allowance for cutting, if and as specified. Several different multiples of the base length may be included in any lot, at the mills' discretion.

Random Lengths—Run-of-mill lengths without any indicated preferred length.

Specific Lengths—Indicated uniform lengths subject to established length tolerances; for example: 12'-0", 9'-7" or ()'-4%" is a specific length.

Specific Lengths With Ends—Indicated uniform lengths of 6 feet or over subject to established length tolerances and with ends included according to established length schedules; for example: 10'-0" with ends or 6'-5" with ends.

Standard Lengths—Standard lengths are lengths which have been recommended in a simplified practice recommendation or established as a Commercial Standard by the National Bureau of Standards, Department of Commerce, as standard lengths for certain products. Products such as copper and red brass pipe, copper water tube, copper threadless pipe (TP), copper refrigeration and general service tube and copper drainage tube (DWV) are furnished in standard lengths.

Stock Lengths—Normally certain uniform lengths subject to established tolerances (including standard lengths) actually carried in mill and warehouse stocks. The nominal length actually carried will vary considerably with the product, alloy, size, and mill source and warehouse location.

MACHINE SHOP TURNING—To denote a condition of turnings, consisting mainly of long streamers intertwined and interlocked in an unwieldy clump like mass.

MAGNETS—This form is too well known to require descriptive amplification: Magnets may range from the miniature (under 2 ounces) to the electronic magnetrons which may weigh upward to 25 pounds. All magnet scrap should be free of insulation or outer shielding covers.

NOTE Magnets, in the magnico category, are highly friable. The examination of the resulting fracture offers some clue to the recognition of the “alnico” v (five) grade in that the fracture of this particular alloy will reveal a large crystalline appearance. The

other alnicos show a distinctive smaller lattice or grain due to the lower cobalt content. Tape shielding contains high sulphur and antimony, and should be removed before melting to prevent contamination.

MALLEABILITY—The property of a metal that permits deformation by rolling, heading, hammering or extension by pressure without fracturing.

MANGANESE BRONZE—See Brasses.

MILLINGS—As distinct from turnings, consist of a finer particle of metal. Usually under three-eighths inch in width or length of thickness, and which is generated through the finishing machining to fine tolerances. Especially prevalent to the close final machining and drilling of bucket blades.

NAVAL BRASS—See Brasses.

NAVAL BRASS WELDING ROD—See Welding, Rod.

NICKEL SILVER—Copper-base alloys containing nickel and zinc, formerly sometimes called German silver. These alloys are primarily used for their distinctive colors which range from yellow to silvery white.

Nickel Silver, 55-18—An alloy nominally containing 55 percent copper, 18 percent nickel and 27 percent zinc.

Nickel Silver, 65-10—An alloy nominally containing 65 percent copper, 10 percent nickel and 25 percent zinc.

Nickel Silver, 65-12—An alloy nominally containing 65 percent copper, 12 percent nickel and 23 percent zinc.

Nickel Silver, 65-15—An alloy nominally containing 65 percent copper, 15 percent nickel and 20 percent zinc.

Nickel Silver, 65-18—An alloy nominally containing 65 percent copper, 18 percent nickel and 17 percent zinc.

NONREFRACTORY—A term applied to those copper-base alloys which, because of a lack of hardness or abrasiveness, present relatively little difficulty in maintaining standard dimensional tolerances.

OXYGEN-FREE SILVER BEARING COPPER (OFS)—See Copper Types.

PELLETS—Synonymous with “Shot,” “granulars,” a pebble-like shape of irregular size and shape, usually under 2 inches, produced by controlled casting of the stream of hot metal into a tank of water.

PICKLING—The process of removing surface oxide and scale from copper alloys with a mill pickle solution consisting of approximately 12 to 15 percent sulfuric acid in water by volume.

PIERCING—(1) The process, also known as the “Mannesmann Process” by which seamless tubes

are made from solid billets. A heated billet is rapidly rotated and driven ahead by drive rolls, the action of which is to form an opening in its center. The forward movement imparted by the rolls carries the shell over a freely rotating mandrel which shapes the inner surface of the tube. (2) Punching holes in sheet or strip, or walls of shells.

PIN TEST—See Tests, Expansion (Pin).

PIPE—Seamless tube conforming to the particular dimensions, commercially known as standard pipe sizes.

PREPARED—Signifies that the physical dimensions of the scrap are in conformance to trade-practice such as “prepared” into bales, or drums, crucible shape, open hearth size, etc.

RADIATOR CORE BRASS—See Brasses.

RANDOM LENGTHS—See Lengths.

READY TO FINISH—A general mill term applied to size and condition of a product prior to the final drawing or rolling operation.

REFINERY—A nonferrous manufacturer who heats secondary material (scrap) in a furnace for the base metal content, melting the metal into intermediate shapes.

RECRYSTALLIZATION—The change in grain structure which occurs when the metal is annealed, during which the deformed grains, strain hardened by working, become new unstrained grains.

ROLLING—The process of passing metal between rolls under pressure to reduce its cross section.

Cold Rolling—This process is carried out below the softening point of the metal and, with copper alloys, usually at room temperature.

Hot Rolling—This process is carried out above the softening temperature and, with copper alloys, usually at temperatures from about 1,200°F. to 1,700°F., 650°C. to 927°C.

ROTATING BAND BLANK—An unfinished tubular blank for making rotating bands for use on artillery projectiles. Sometimes termed **driving band blank** or **projectile band blank**.

SAWED BAR—A bar brought to finished width by sawing.

SAWED EDGES—The edges resulting when a product is brought to final width and length by sawing. The edges are parallel and at right angles to the rolled surface.

SCALE—(1) A heavy oxide coating on copper and copper-base alloys resulting from exposure to high temperatures in an oxidizing atmosphere. (2) A product resulting from the corrosion of metals.

SCRAP BROKER—A scrap broker is a buyer and seller of scrap for his own account but does not physically handle the material.

SCRAP BROKER-DEALER—A brokerdealer performs primarily the functions of a broker but also maintains a physical inventory of scrap and processes material for his own account.

SCRAP DEALER—A scrap dealer is an operator of a scrap yard taking physical possession of the material for the purpose of sorting and preparing scrap to meet mill specifications and requirements.

SHORT SHOVELING—When applied to scrap solids or turnings, means material of such dimensional size which can be manually handled by a shovel.

SLAB—A casting in the form of a bar used for rolling into strip.

SLUDGE—A mudlike material originating from the chemical industry or the ceramic industry, in the form of a residue scrap byproduct, or as a spent catalyst, or in the form of other chemical substances. Sludge, or such type of scrap should be offered in the following indicated manner: (1) Moisture content. (2) Assay to be established on dry content. (3) When feasible, the metallic yield for the dry content should be supplied.

SMEALTER—A nonferrous manufacturer which produces a shape wherein the prime ingredient is ore.

Custom Smelter—Melts secondary material (scrap) into refined copper.

Secondary Smelter—Melts scrap material into specification ingots.

SOLDERING—Joining metals by fusion of alloys that have relatively low-melting points—most commonly, lead-base or tin-base alloys, which are the soft solders. Hard solders are alloys that have silver, copper or nickel bases. Use of these alloys with melting points higher than 8000 F., 4270 C. is properly called “brazing.”

SOLIDS—Trade term “solids” covers almost every conceivable shape manufactured for commercial or military application. It applies to the trade term titled “generated scrap” in solid form. Also, see “Specifics.”

SPAGHETTI—Pertinent to solids, conjures an optical or mental picture of a jumbled mass of voluminous condition, unprepared scrap, irregular and numerous varied large shapes and sizes. Particularly, pertinent to long streamers of sheet cuttings, slittings, wire and cable whereby one end of the piece is at one part of the pile and the other end is intertwined.

SPECIFICS—The following enumerated descriptions are indicative and exemplify the proper meaning of the term “solids.”

Blades—Shall refer to the turbine rotor blades or bucket blades associated with the jet engine or the steam engine, and which is the motive part on which the gas or pressure stream impinges and

transmits the power to create motion. Blades are produced from forgings or are tamped to critical dimensions. Bucket blades may range in weight from an ounce to several pounds.

Clippings—Refers to cuttings, stampings, trimmings, resulting from the fabrication and working of new sheet metal.

NOTE: “New,” by trade custom refers to plant generated scrap.

Jet Solids—Occurring mainly from sheet stock fabricated parts utilized in the hot section of the jet engine and found mostly in the form of shrouds, outer casings, braking flaps, tail cones, after burners, nozzles, and other engine parts.

NOTE: The weight saving requirement of the jet engine necessitates using thin gage metal, (8 to 22 gage) which often is stiffened by bracing sections to avoid metal warping under extreme heat conditions. Often the braces are made of other nickel containing heat-resisting alloy. These braces or other attachments are usually of minor ratio and since the metal content is of a nonharmful nature, a small tolerance of such braces or attachments may be included in the overall lot.

Old Sheet—Salvage—in the form of sheet occurring from obsolete, rejected or service retired scrap. May include material with brazed seams, also some slight attachment of nonharmful metal attachment.

Solids Other—The following are usually present in the scrap delineation and need no elaborate further description, namely; rod and bar ends, pipe ends, plate cuttings, bolts and nuts, billet ends, forgings, flashing, etc.

SPELTER—Mill term for cast zinc. Spelter usually is produced in the form of flat slabs for remelting.

SPIII—A defect which originates during casting and after rolling or drawing appears as a discontinuity either on the surface or as a faint streak which on distortion becomes opened or blistered.

SPOT PLATE—A nonreactive nonporous glass or mineral plate with one or more shallow depressions in which to perform chemical reagent identification testing of metal filings, chips, or borings.

STEEL MILL:

Integrated Steel Mill—A manufacturer of steel who owns or controls all of the ores, materials, and physical facilities for manufacturing steel from raw material to the finished steel, with the exception of purchased scrap.

Nonintegrated Steel Mill—Lacks ownership or control of certain phases of manufacturing steel

and usually purchases from other firms the necessary ingredients as phases of operation required to complete the cycle of the steel manufacturing process.

STRAIGHTENING—Any process applied to tube, rod, bar, or wire that eliminates any general or local curvature resulting from mill processing.

Hand Straightening—The process of straightening by bending or twisting by hand with the aid of adjustable supports and suitable hand tools, usually applied to shapes and to large diameter tubes.

Inclined Roll Straightening—(Such as Medart). The process of straightening round rod or tube by passing the product through a machine with rolls having special contours and whose axis are at a slight angle so as to give the product a helical forward motion with repeated flexing in all planes through the axis.

Roll Straightening—The process of straightening tube, rod and bar by passing lengthwise through a machine with suitable rolls so as to repeatedly flex the product in two planes at right angles.

STRAIGHTENING AND FLATTENING—Any process applied to flat-rolled products to eliminate any general or local curvature, either with respect to flatness or edgewise curvature.

Roll Flattening—The process of flattening a product by machine with a number of small diameter cylindrical rolls so positioned as to repeatedly flex the product and thus remove certain irregularities in shape. Roll flattening practically eliminates longitudinal curl, burr, and dish. It reduces edgewise curvature of narrow strip. This operation reduces buckles, but is relatively ineffective in eliminating wavy edges, ripples and twist. Roll flattening is ordinarily applied to a flat-rolled product within the approximate size range .010 inch to $\frac{1}{8}$ inch thick and in widths to about 48-inch, and is particularly effective on annealed tempers, but is progressively less effective with increase in degree of rolled temper.

Stretcher Straightening (Patent Leveling)—Applicable to flat straight lengths. A process which simultaneously flattens and straightens a product by longitudinally stretching it beyond its elastic limit. This process removes buckles, ripples, wavy edges, twist and edgewise curvature, is partially effective in removing longitudinal curl but is ineffective in removal of crown, dish and burr. It is commonly applied to flat-rolled products within the approximate size range of 3-inch to 48-inch wide and 0.012 inch to 0.050 inch thick. It is particularly effective on all annealed tempers and on rolled tempers up to half hard.

STRETCHER STRAIGHTENING—See Straightening and Flattening.

STRESSES:

Applied Stress—Stresses that are set up and exist in a body during application of an external load.

Residual Stress—Stresses that remain within a body as the result of plastic deformation, casting or rapid temperature change.

STRESS CORROSION—See Corrosion.

STRIP—A flat product, other than flat wire, up to and including thickness and generally furnished as follows (1) With slit, sheared or slit and edge rolled in widths up to 20-inch inclusive. (2) With finished drawn or rolled edges in widths over 1 $\frac{1}{4}$ -inch to 12-inch inclusive.

TEMPER—The condition produced in a metal by mechanical or thermal treatment and having characteristic structure and mechanical properties.

TENSILE STRENGTH—The value obtained by dividing the maximum load observed during tensile straining by the specimen cross-sectional area before straining. Also called "ultimate strength." It is usually expressed in pounds per square inch.

Bend—A test sometimes made to indicate ductility or bending a suitable specimen about a predetermined radius through a predetermined angle.

Brinell Hardness—A test made to determine hardness on relatively thick sections of metal by pressing a steel ball of specified diameter into a test specimen under a specified load. This test is seldom used on copper and copper-base alloys.

Creep—A test to determine the extension of metallic materials due to the combined effects of temperature, tensile stress and time. Inherently, it is a long term test not suitable for specification purposes.

Cup—A test to indicate the ductility of sheet or strip wherein a cup is drawn from the metal until it fractures. Several modifications of the original Erichsen method are now in use.

Endurance—A test to determine the endurance limit of a metal's resistance to fatigue by subjecting a specimen to repeated alternating or pulsating stresses.

Expansion (pin)—A test used to determine the capacity of the tube for expansion, to reveal surface defects of the tube for expansion and to reveal surface defects by pushing a tapered pin into the open end of a specimen.

Flattening—A test made on annealed tube to indicate ductility and freedom from mechanical defects.

Hydrostatic—A test to prove soundness and resistance to leakage of tube and pipe under internal water pressure.

Impact—A test made to determine the resistance of metals to failure by sudden shock load.

Mercurous Nitrate—An accelerated test to indicate the resistance of copper-base alloy products to season cracking.

Pneumatic—A test used to prove resistance to leakage of tube or pipe by the application of internal air pressure to the product while submerged in water.

Rockwell Hardness—A test to measure hardness by determining the depth of penetration into a specimen of a penetrator under predetermined conditions of test.

Tension—A test to determine one or more of the following tensile strength, yield strength, elongation and contraction of area.

Torsion—A test to determine the strength in torsion by measuring the torque required to twist a specimen of given length through a predetermined angle.

TOLERANCE—The amount by which any characteristic, such as dimensional, chemical, physical or mechanical properties, may vary from that specified.

TUBE—A hollow product of round or any other cross section having a continuous periphery.

Copper Service Tube—Bandable copper water tube for underground water services. See Copper Water Tube.

Copper Water Tube—Seamless copper tube conforming to the particular dimensions commercially known as copper water tube and designated as types "K," "L," and "M."

Heat Exchanger Tube—Tube manufactured to special requirements as to dimensional tolerances, finish and temper for use in condensers and other heat exchangers.

Lock Seam Tube—Tube made from sheet or strip, with a longitudinal, mechanically locked seam.

Oil Burner Tube—Small diameter seamless copper tube of soft temper in coils intended for use in oil burner installations.

Open Seam Tube—A shape, other than extruded shape, of generally tubular form of nominally uniform wall thickness but having a longitudinal unjoined seam or gap of width not greater than 25 percent of the outside diameter or greatest overall dimension.

Pipe, Seamless—Tube conforming to the particular dimensions commercially known as standard pipe sizes (SPS) and designated as regular and extra strong.

Reeded Outside, Plain Inside Tube—Tube having reeded outside periphery and plain inside periphery.

Reeded Tube—Tube of nominally uniform wall thickness having regular longitudinal convex cor-

rugations, either with rounded or sharp cusps between corrugations.

Seamless Tube—Tube produced with a continuous periphery at all stages of the operation, in contrast to "brazed," "welded," "open seams," and "lock seam" tube.

Welded Tube—Tube made from sheet or strip, with a longitudinal welded joint.

TURNINGS—Likewise trade described as "borings" and "shavings." Results from machining operation and processing of bars, rods, castings, billets, or the machine dressing or finishing of any metal product which results in the occurrence of the usual sliver-like or curlicue shapes. This is generic to the term "turnings." The term "machine shop turnings" indicates that the scrap is voluminous and in bulky condition.

WELDING—Process of producing localized coalescence of metal by heating to suitable temperatures, with or without the application of pressure, and with or without the use of filler metal. The filler metal either has a melting point approximately the same as the base metal, or has a melting point below that of the base metals, but above 800° F. Common welding processes are (1) carbon arc welding, (2) metal arc welding, (3) oxyacetylene welding, (4) resistance welding, and (5) shielded arc welding.

WELDING ROD—Filler metal, in wire or rod form, used in gas welding and brazing processes, and those arc-welding processes wherein the electrode does not furnish the filler metal. Some commonly used welding rods are:

Aluminum Bronze—A copper-base alloy having aluminum as the major alloying element with or without a small amount of iron.

Copper—Deoxidized copper containing minor additions of other elements.

Cupro-Nickel, 30 percent—Copper-base alloy having nickel as the major alloying element (about 30 percent) with minor additions of other elements.

Low Fuming—Manganese Bronze type welding rod to which a small amount of silicon has been added to reduce the evolution of zinc oxide fumes in welding or brazing.

Manganese Bronze Welding Rod—A copper-base alloy in which manganese is present in small amount. Usually also contains small quantities of iron and tin. A typical analysis would show about 57 percent copper, 0.7 percent tin, 0.7 percent iron, 0.10 percent manganese, and the remainder zinc.

Naval Brass—An alloy of approximately 60 percent copper, 0.7 percent tin and the remainder zinc.

Phosphor Bronze—A copper-tin containing residual phosphorus.
Silicon Bronze—A copper-base alloy having silicon as the major alloying element up to 4 percent

with or without lesser amounts of any of several elements such as zinc, tin, manganese, and iron.

